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SOVRaD - A DIGEST OF RECENT SOVIET R AND D ARTICLES,
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S. Hibben, et al

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A Digest of Recent Soviet R & D Articles

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INTRODUCTION

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For further information the reader is invited to call Stuart Hibben or Lee Boylan at Informatics on (301)-770-3000.

International Conference on Artificial Intelligence (extract)

The Fourth International Joint Conference on Artificial Intelligence was held recently in Tbilisi, USSR. The eleven-section conference was attended by more than 1000 delegates representing 35 nations. In response to general questions from a correspondent, Candidate of Technical Sciences Ye. A. Aleksandrov describes a mobile robot platform developed by the Institute of Cybernetics of the Ukrainian Academy of Sciences, based on operating principles developed by N. M. Amosov. The platform is said to be somewhat similar in external appearance to the Soviet lunar rover. It can negotiate an obstacle course in its self-propelled route to an object. Aleksandrov concludes that the conference demonstrated three areas for further work: 1) the study of the intelligence of man as a personality; 2) the development of models for man's information processing; and 3) a thorough knowledge of the sphere of human endeavor in which these models should be used. [A thinking machine? Sovetskaya Rossiya, 23 September 1975, p. 4 cols. 2-3].

Radiometry of Oil Slicks (abstract)

Laboratory measurements are reported of the radio brightness temperature of a smooth water surface covered by oil or kerosene films, as measured by a high-sensitivity centimeter-band radiometer. Experimental data on dependence of the increment of radio brightness temperature on the thickness of the film are compared to theoretical data obtained in an isothermal approximation.

A brief description of the radiometer is given, together with graphical data on differential brightness temperature as a function of film thickness and signal polarization for $\lambda = 2.08$ cm.

The results of this analysis confirm the possibility for remote detection of films of liquid oil products over a calm water surface by high-sensitivity radiometry. A centimeter-band radiometer should thus be able to detect films with thickness on the order of 0.1 nm. [Glotov, A. A., D. T. Matveyev, V. G. Mirovskiy, M. D. Rayev, V. Yu. Rayzer, I. A. Troitskiy, Ye. A. Sharkov, and V. S. Etkin. Study of radic-frequency thermal emission of a water surface, covered by an oil film. Meteorologiya i gidrologiya, no. 6, 1975, 90-93].

Thermoplastic Film for Optical Storage (verbatim)

Experimental and theoretical studies have been made of inhomogeneities in the thickness (phase noise) of a new material for information storage: thermoplastic films. Broadening and narrowing of the output signal of a coherent optical system, which transforms sinusoidal signals recorded on thermoplastic, are considered. An evaluation is made of resolution and dynamic range of the system. The concept of "noise coefficient of the information carrier" is introduced which makes it possible to compare various carriers. A study of dependence of noise coefficient on spatial frequency is also discussed. [Aymbinder, M. S., N. M. Borovitskaya, T. G. Vlasova, Ye. Yu. Zul'karnayeva, F. A. Markus, P. Ya. Mel'nichenko, J. V. Miroshnichenko, and V. V. Shutovskiy. Thermoplastics in a coherent optical system. IVUZ Radiofiz, 1974, 17, no. 10, 1493-1500. (RZhF, 4/75, no. 4D1048)].

Matrix Indicator (verbatim)

A matrix indicator is proposed which contains isolated transparent substrates with horizontal and vertical electrodes, and a liquid-crystal filler. To eliminate crosstalk, a transparent plate is placed between adjacent substrates; on each side of the transparent plate a transparent conductive coating is applied. The space between the plate and substrates is filled with the liquid crystal substance. [Anisimov, A. N., and A. V. Veselovskiy. Matrix indicator. Author's Certificate, USSR, No. 421971, published 3/9/74. (RZhElektr, 4/75, #4B394 P)].

Imaging Characteristics on Thermoplastic (abstract)

Effects of the parameters of thermoplastic information carriers on the intensity of light in an image reproduction plane is considered. Analytical expressions are obtained and analyses are given which correlate gradation of image with light wavelength, refractive index, depth of deformation and thickness of the thermoplastic layer, as well as with characteristics of recording electron beam. Results obtained show that an increase in thermoplastic layer thickness also increases the effective exposure range, and lowers the coefficient at surface tension, γ . At sufficiently great thickness, qualitative image reproduction is possible only with higher exposure levels. Increasing the electron beam width reduces the exposure range and increases the image contrast, but the resolving power of recorded information on the thermoplastic layer is reduced.

The cited findings enable selection of concrete values of the thermoplastic layer thickness and electron beam radius, so that the desired γ and effective exposure range are obtained. [Valentyuk, A. N., and K. G. Predko. Characteristics of optical imaging from thermoplastic carriers. Ois, v. 39, no. 1, 1975, 186-189].

Discrete Optical Imaging (verbatim)

A patent disclosure has been filed on a system for quantizing and transmitting an optical image. The design includes a matrix of dielectric waveguides and multimode output with horn transmitter. To obtain the multimode regime for excitation and conversion of the focused image to discrete form, the matrix is designed in the form of a two-dimensional plate fixed with a regular pattern of polymer fibers of the required length. [Pudagyan, I. F., V. F. Dubrovin, S. N. Kamlyuk, D. I. Mirovitskiy, and V. S. Chagulov. Device for quantization and transmission of an optical image. Author's Certificate, USSR, no. 438070, submitted 14 Dec. 1972, awarded 1 Aug. 1975. (RZhRadiot, 7/75, no. 7Yell6 P)].

Improved Glass For Optical Registry (abstract)

Various chalcogenide glasses used for optical recording of data are discussed, and a Cu-As-Se-I system is proposed which has improved write/erase characteristics. The proposed type is compared to existing types, namely As_2Se_3 , As_2S_3 and AsSeI , which show relatively poor erase and rewrite response. Comparative response of the new type shows good repeatability of registering quality up to seven write/erase cycles. The

governing factors are discussed in terms of reordering stability in the chain-layer structures of the glasses. Experiments described used a He-Ne laser for data recording. [Kikineshi, A. A., and D. G. Semak. Reversibility of photoprinting on glasses of the Cu-As-Se-I system. ZhTF P, v. 1, no. 6, 1975, 269-273].

Radioactive Thermometer?

The possibility of affecting the decay rate of a radioactive body by intense laser application was suggested, for example, by Gol'danskiy and Letokhov (ZhETF, v. 67, no. 2, 1974, 513-516). A subsequent article by G. Voronov speculates further on this idea, noting that lasers of the required energy are now available to realize such an experiment, for example with Tc^{99} as a target. The intense ionization of the radioactive specimen should measurably retard the decay rate. The fact that intensity of radioactivity thus depends on degree of ionization suggests the possibility of using the technique to measure the resultant high temperatures, i.e. in the order of 10^6 degrees. [Voronov, G. Lasers and radioactivity: Soviet scientists propose use of a laser to control radioactive decay rate. Khimiya i zhizn', no. 3, 1975, 8].

Imploded Fusion Plasma (abstract)

A theta-pinch magnetic compression system using an explosion-accelerated metallic liner to initiate a controlled nuclear fusion process is described by a closed set of equations. The equations take into account compressibility and viscosity of the liner material and the explosive. Solution of the equations by the finite differences method gives the optimum parameters of the system, i.e., system geometry, explosive quantity, plasma initial temperature and density, which would be required to conduct an experimental verification of the possibility for achieving energy conversion efficiency corresponding to the Lawson criterion. Fusion energy released in the experiment should be equal to energy stored in the explosive charge. [Churayev, V. A., K. M. Lobanov, V. P. Fedyakov, V. D. Dyatlov, and A. M. Timonin. Plasma compression by an explosion-accelerated conducting liner. ZhTF, no. 7, 1975, 1375-1380].

Metallic Water (abstract)

Another in the series of high-pressure phase conversion tests by Vereshchagin's group is reported. In this experiment, ice at -80 to -10 C was compressed at one megabar and its electric resistance R was measured. The data show that, at a certain value of applied force, R at 200 K dropped by six orders of magnitude. R of the specimen reverted to its original value on being heated to 220 K. The observed "defrosting" of the conducting state led the authors to conclude that the metastable conducting water reverts to the original dielectric phase. Thus, R discontinuity under pressure is related to a phase conversion. [Vereshchagin, L. F., Ye. N. Yakovlev, and Yu. A. Timofeyev. Conversion of water into conductive state at ~ 1 Mbar static pressure. ZhETF P, v. 21, no. 11, 1975, 643-645].

Battery With Water Oxidizer (verbatim)

The possibility is shown for substantially raising the unit power characteristic of water-activated current sources by using water as the oxidizing agent. Several anode and cathode materials are proposed, whose use in the suggested type of battery could achieve a unit energy output of 350 watt-hrs/kg. [Berkman, Ye. A., Ye. G. Ivanov, G. M. Potrova, A. B. Pospelov, B. V. Chulkov, and V. A. Barsukov. Electrochemical generators using water as oxidizer. IN: Sb. rabot po khim. istochnikam toka. Vses. n-i. akkumulator. in-t., no. 10, 1975, 391-401. (RZhElektrotekh, 21F, 8/75, no. 8F124)].

Magnetic Holography (abstract)

Principles of holographic recording of information on magnetic tapes are studied, in which recorded information can be in discrete form or as a phase hologram. Requirements on the optical system for discrete recording are considered. A major factor which determines the density of recording of discrete data by the cited thermomagnetic method is the quality of the optical system; a feasible density is 5×10^6 bit/cm². The important characteristics of the thermomagnetic material in the readout process of discrete information is its signal-to-noise ratio, and a quality index for the thermomagnetic material based on Faraday rotation and coefficient of absorption. Materials such as EuO or EuS have good quality indices (10^6 deg/cm) at cryogenic temperatures.

The holographic method of recording on magnetic tape is interesting for its high noise rejection as well as its high recording density and fast readout. Its drawbacks are a low diffraction intensity ($\sim 10^{-2}\%$) and the need to use a laser with high output power. The possibility is discussed for production of transparencies with magnetooptic control on the basis of magnetic bubble domains. [Petrov, M. P. Magnetic holography. IN: Sb. Materialy 6-y Zimnoy shkoly po fizike poluprovodnikov, 1975. Leningrad, 1974, 257-279. (RZhRadiot, 5/75, no. 5E261)].

Laser Pumped by Relativistic E-Beam (verbatim)

Experiments are described in which relativistic electron beams were used to excite gas lasers. Advantages of laser pumping by relativistic beams, as compared to other techniques, are discussed. The results are described of the study of energy transfer from the relativistic beam to the host gases, which are under various conditions, so as to arrive at the optimum operating regimes of such lasers. Neon, molecular nitrogen, and hydrogen lasers were developed. The maximum output using nitrogen attains 4×10^6 w at a pulse duration of 8 nanoseconds. [Magda, I. I., Yu. V. Tkach, Ya. B. Faynberg, and G. V. Skachek. Use of relativistic electron beams in producing powerful optical pulse generators. IN: Sb III Ukr. resp. konf. po elektron. optike i yeye primeneniym, posvyashch. 250-letiyu AN SSSR, 1974. Tezisy dokl. Ch. 2. Khar'kov, 1974, 166-167. (RZhRadiot, 5/75, #5Ye28)].

Romania Plans Oceanographic Research Institute and Fleet (abstract)

Following a brief discussion of Romanian participation in international oceanographic research projects, Professor M. Bacescu states that by 1978, Romania will have well-equipped vessels for fisheries and oceanographic research. The problem of ocean resources development is to be the prime mission of a "future" Romanian oceanographic institute. [Bacescu, M. The resources of the ocean. Romania Today, no. 7, 1975, 32-33].

Characteristics of Dolphin Sonar (verbatim)

Results are summarized on studies of the echo-ranging mechanism of dolphins. The techniques are described of sound recording directly on the head of the dolphin. These techniques make it possible to detect amplitude and shape of signals at different points on the surface of the dolphin's head. Mechanisms of sound generation are proposed; the most probable sound-emitting elements are thought to be air cavities which are excited by impact. In the case of HF pulses, the radiation has a non-resonant character, while for LF pulses, it is weakly resonant.

Experiments on directivity of radiation show that while the skull plays a major role, the soft tissue of the dolphin's head also plays a definite part in narrowing the directional pattern at high frequencies. Possible mechanisms of sound reception by dolphins are also discussed. The results are given of the study of noise stability of the dolphin's echo-ranging mechanism, as well as the capability to determine the direction toward the sound source and to distinguish underwater objects. A method is described for the protection of the dolphin hearing organ (*Tursiops truncatus*) against intense echo-ranging pulses by skull shielding together with a system of air-containing ducts. Methods for evaluating the efficiency of a dolphin's echo-ranging mechanism are given. [Romanenko, Ye. V. Some characteristics of dolphin echo-ranging mechanisms. Trudy 5-y Vsesoyuznoy shkoly-seminara po stat. gidroakustike (SG-5). Novosibirsk, 1974, 316-331. (RZhF, 6/75, #6Zh979)].

Model For Focusing an Acoustic Wave (abstract)

An approximate model for the diffraction structure of a focused acoustic field in its focal plane is offered. The treatment is mainly simplified by accounting for nonlinearity and diffraction separately, even though their effects occur simultaneously; the resulting approximation gives a reasonably accurate description of the space-time characteristics of the focused field. Several variants are treated, including subsonic and supersonic excitation. The authors note that neglecting nonlinearity is actually only justifiable at sufficiently high sonic frequencies, e. g. 20 MHz in water.

A numerical example is given to illustrate optimum conditions for the combined nonlinear and diffraction effects. This shows that for

excitation at 1.5 MHz in water, maximum gains will attain 8 kw/cm^2 at the focus, which is half again as much as the value obtained without accounting for nonlinearity, but still below cavitation threshold. [Ostrovskiy, L. A., and A. M. Sutin. Focusing finite-amplitude acoustic waves. DAN SSSR, v. 221, no. 6, 1975, 1300-1303].

Recent Publications

Ayzinov, M. M., and A. M. Bayrashevskiy. Radiotekhnika i radionavigatsionnyye pribory. Uchebnik. (Radio-frequency techniques and radio-navigational instruments. Textbook). Moskva, Transport, 1975, 431 p. (LC-VKP)

Druzin, Ya. V., and S. E. Koganer. Televizionnyye sistemy otobrazheniya informatsii. (Television data-display systems). Leningrad, Energiya, 1975, 78 p. (LC-VKP)

Elektronnyye charakteristiki i elektron-fononnyye vzaimodeystviya sverkhprovodyashchikh metallov i splavov. (Electron characteristics and electron-phonon interactions of superconducting metals and alloys). Fizicheskii institut im. P. N. Lebedeva. Trudy, no. 82. Moskva, Nauka, 1975, 102 p. (LC-VKP)

Fedotov, Ya. A. Poluprovodnikovaya elektronika, god 2001-y. (Semiconductor electronics in the year 2001). Moskva, Sov. radio, 1975, 102 p. (LC-VKP)

Gorn, L. S., and B. I. Khazanov. Izbiratel'nyye radiometri (Selective radiometers). Moskva, Atomizdat, 1975, 373 p. (LC-VKP)

Issledovaniye elektricheskikh silovykh impul'snykh sistem. Sbornik nauchnykh trudov. (Investigation of electrical pulsed power systems. Collection of scientific papers). Novosibirsk, Institut gornogo dela, 1974, 143 p. (LC-VKP)

Kalinina, L. S. Kachestvennyy analiz polimerov. (Qualitative analysis of polymers). Moskva, Khimiya, 1975, 245 p. (LC-VKP)

Karinskiy, S. S. Ustroystiv obrabotki signalov na ul'trazvukovykh poverkhnostnykh volnakh. (Device for processing ultrasonic surface-wave signals). Moskva, Sov. radio, 1975, 175 p. (LC-VKP)

Metrologicheskiye voprosy radiofiziki. Sbornik statey. (Metrological problems of radiophysics). Meteorologicheskiye instituty SSSR. Trudy, no. 158 (218). Leningrad, VNIIM, 1974, 154 p. (LC-VKP)

Novyye metody issledovaniya polimerov. Sbornik statey. (New methods in polymer research. Collection of articles). Kiyev, Nauk. dumka, 1975, 199 p. (LC-VKP)

Oleynik, E. F., A. L. Buchachenko, and Ye. V. Anufriyeva. Spektroskopicheskiye metody issledovaniya polimerov. (Spectroscopic methods of polymer research). Moskva, Znaniye, 1975, 63 p. (LC-VKP)

Orlova, Ye. Yu., et al. Oktogen - termostoykoye vzryvchatoye veshchestvo. (Octogene - a heat-resistant explosive). Moskva, Nedra, 1975, 125 p. (LC-VKP)

Protsessy rosta i sinteza poluprovodnikovyykh kristallov i plenok. Materialy simpoziuma. (Growth and synthesis processes of semiconductor crystals and films. Proceedings of symposium). Novosibirsk, Nauka, Sib. otdeleniye, 1975. (LC-VKP)

Rubinchik, L. Ye. Elektropechi s nagrevatelyami iz karbida kremniya. (Electrical furnaces with silicon carbide heaters). Moskva, Energiya, 1975, 94 p. (LC-VKP)

Tekhnologiya stroitel'noy keramiki i iskusstvennykh poristyykh zapolniteley. Sbornik statey. (Technology of structural ceramics and artificial porous fillers. Collection of articles). Gosudarstvennyy VNII stroitel'nykh materialov i konstruktsiy, VNIISTROM. Sbornik trudov, no. 29(57). Moskva, 1974, 159 p. (LC-VKP)

SOURCE IDENTIFICATION

IVUZ Radiofiz	-	Izvestiya vysshikh uchebnykh zavedeniy. Radiofizika
RZh Elektr	-	Referativnyy zhurnal. Elektronika i yeye primeneniye
OiS	-	Optika i spektroskopiya
RZhRadiot	-	Referativnyy zhurnal. Radiotekhnika
ZhTF P	-	Pis'ma v Zhurnal tekhnicheskoy fiziki
ZhTF	-	Zhurnal tekhnicheskoy fiziki
ZhETF P	-	Pis'ma v Zhurnal eksperimental'noy i teoreticheskoy fiziki
RZhElektrotekh	-	Referativnyy zhurnal. Elektrotehnika
RZhF	-	Referativnyy zhurnal. Fizika
DAN SSSR	-	Akademiya nauk SSSR. Doklady